CLAIMS

1. A process for forming a fluid tight seal between a polymeric body and a polymeric dilatation member surrounding the body, comprising the steps of:

positioning a dilatation member of polymeric material along and in surrounding relation to a body of polymeric material, with the dilatation member and body aligned to place a first surface portion of the dilatation member and a second surface portion of the body in a contiguous and confronting relation;

generating substantially monochromatic energy at a wavelength selected to at least approximately match a wavelength of maximum spectral absorption of the polymeric materials forming the dilatation member and body;

controllably directing the monochromatic energy onto the body and the dilatation member to concentrate the monochromatic energy in a narrow bond site circumscribing the body and running along the interface of the first and second surface portions, thus to melt the polymeric materials along said bond site and the immediate region thereof; and

allowing the previously melted polymeric material to cool and solidify to form a fusion bond between the body and dilatation member.

2. The process of Claim 1 wherein:

said interface of the first and second surfaces is annular, and the step of directing the monochromatic energy includes focusing the beam to position a focal area of the beam substantially at the interface, and moving the focal area, relative to the body and the dilatation member, in an annular path along the interface to define said bond site.

3. The process of Claim 2 wherein:

the step of moving the focal area includes mounting the body and dilatation member substantially concentrically on an axis, and rotating the body and the

dilatation member about the axis while maintaining the beam stationary.

4. The process of Claim 3 wherein:

the focal area is circular and has a diameter of about 0.10 inches, and wherein the power of the laser is in the range of from 1-10 watts.

5. The process of Claim 4 wherein:

the body and dilatation member are rotated at a speed of about 400 rpm for a duration in the range of from about 0.5 to about 3 seconds.

6. The process of Claim 2 wherein:

the step of rotating the focal area relative to the body and dilatation member includes mounting the body concentrically about an axis, and optomechanically rotating the beam about the axis while maintaining the body and dilatation member stationary.

7. The process of Claim 2 wherein:

the monochromatic energy is laser energy having a wavelength in the far infrared range.

8. The process of Claim 7 wherein:

the wavelength of the laser energy is approximately 10.6 micrometers.

9. The process of Claim 1 wherein:

the step of directing the monochromatic energy includes providing multiple optical carriers arranged generally radially about the body and the dilatation member, and providing the monochromatic energy to the optical carriers simultaneously whereby the energy is directed in multiple beams that penetrate the body and dilatation member assembly at least to the interface.

10. The process of Claim 9 wherein:

the multiple beams overlap one another at the interface.

11. The process of Claim 10 wherein:

the monochromatic energy comprises laser energy in the near infrared range.

12. The process of Claim 11 including the further step of:

prior to positioning the polymeric dilatation member, coating at least one of said first and second surfaces with a polymeric film highly absorbent of energy in the near infrared range of wavelength.

13. The process of Claim 1 including the further step of:

positioning a polymeric shrink fit member in surrounding relation to the dilatation member and body, before said step of directing the monochromatic energy.

14. The process of Claim 13 including the further step of:

removing the polymeric shrink fit member, following the step of allowing the melted polymeric material to cool and solidify.

15. The process of Claim 1 wherein:

the body is a length of catheter tubing, and the dilatation member is a catheter balloon positioned along a distal end region of the catheter tubing and including proximal and distal neck portions, a medial region having a diameter substantially larger than that of the neck portions, and proximal and distal tapered conical regions between the medial region and respective neck regions; and

wherein the step of directing the monochromatic energy includes forming the bond site along the interface between the distal neck and the catheter tubing, separated from the distal tapered conical region by an axial distance of less than .030 inches.

7 ~~16.~~ A balloon catheter comprising:

P1 an elongate pliable length of catheter tubing formed of a polymeric material and having a proximal end and a distal end;

P1 a polymeric dilatation balloon mounted to the catheter tubing near the distal end and in surrounding relation to the catheter tubing, said balloon including a

medial region, proximal and distal neck regions each substantially smaller in diameter than the medial region, and proximal and distal tapered regions between the medial region and the proximal and distal neck regions, respectively, each tapered region diverging in the direction from its associated neck region to the medial region; and

~~annular~~ proximal and distal fluid tight fusion bonds between the catheter tubing and the proximal and distal neck regions, respectively, wherein each of the proximal and distal fusion bonds is within .030 inches of its associated one of the proximal and distal tapered regions, and wherein each of the proximal and ~~distal~~ tapered regions is substantially free of crystallization.

8 ~~17~~. The balloon catheter of Claim 7 ~~16~~ wherein:

the inner diameter of the distal neck portion is substantially equal to the outer diameter of the catheter tubing in the region of said distal fusion bond, and the inner diameter of the proximal neck region is substantially equal to the outer diameter of the catheter tubing along the proximal fusion bond.

9 ~~18~~. The balloon catheter of Claim 8 ~~17~~ wherein:

the catheter tubing, neck regions and fusion bonds are annular.

10 ~~19~~. The balloon catheter of Claim 9 ~~18~~ wherein:

the axial dimension of the distal fusion bond is at most .030 inches.

11 ~~20~~. The balloon catheter of Claim 10 ~~19~~ wherein:

the axial length of the distal fusion ~~bond~~ is about .020 inches.

12 ~~21~~. The balloon catheter of Claim 11 ~~20~~ wherein:

the distal fusion bond is less than .010 inches from the distal tapered region.

13 ~~22~~. The balloon catheter of Claim 7 ~~16~~ wherein:

the catheter tubing comprises an extrusion of at least one thermoplastic polymeric material chosen from the group consisting of: polyesters, polyolefins,

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Polyamides ~~polyimides,~~ thermoplastic polyurethanes and their copolymers.

14 ~~23~~. The balloon catheter of Claim 13 ~~22~~ wherein:

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the balloon is formed of at least one of the materials from the group consisting of: polyethylene terephthalate, nylon, polyolefin, and their copolymers.

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